**North Carolina Science Essential Standards**

**Grade Five Unit Planning Pack**

**Subject Area/Grade:** Life Science, grade 5 **Title:** Human Body Structures and Systems

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| **1 Unit Theme:**  *(to be completed by the unit organizer)* |
| **2 Conceptual Lens:**  *(to be completed by the unit organizer)* |
| **3 Identify the Big Ideas:**  *(Align to Essential Standards)*  Structure and Function in Living things  Systems, Dependence, Inter- and Intradependence |
| **4 Enduring Understanding**  *(Generalizations)*  There are structures and systems in organisms that are independent as well as interdependent. The structures in living things function to meet the needs of living things.  All living things are composed of cells. Some living things consist of a single cell. Some living things are made of a collection of similar cells. Some organisms' cells vary greatly in appearance and perform very different roles in the organism. Different cells can work together as a system in an organism to coordinate activities that meet its needs.  All living things have similar needs. They need food, water, and air; a way to dispose of waste; and an environment they can live in.  Parts of the human body interact for growth and survival. Humans have distinct body systems. |
| **5 Essential Questions**  *(Guiding Questions)*  How are structure and function related in living things?  What are the systems of the human body? What features of the human body (structure and function) are common to all humans? How do human body systems function? How are parts of human body systems independent, and interdependent? |
| **NC Science Essential Standards**  **5.L.1 Understand how structures and systems of organisms (to include the human body) perform functions necessary for life.**  5.L.1.1 Explain why some organisms are capable of surviving as a single cell while others require many cells that are specialized to survive.  5.L.1.2 Compare the major systems of the human body (digestive, respiratory, circulatory, muscular, skeletal, and cardiovascular) in terms of their functions necessary for life. |
| **Essential Terminology**  Unicellular multicellular transport  Circulatory System heart, blood, vessels  Respiratory System nose, trachea, lungs  Skeletal System bones  Muscular System muscles  Digestive System mouth, esophagus, stomach, intestines |
| **GRAPHIC ORGANIZERS:**  NC Science Essential Standards; Life Science Domain; Structures and Functions of Living organisms Strand  Atlas of Science Literacy Volume I page 75, Volume II page 41  Human body systems <http://www.eduplace.com/science/hmsc/content/organizer/4/org_4a_2.pdf>  Arteries and Veins venn diagram  <http://www.eduplace.com/science/hmsc/content/organizer/4/org_4a_2_2.pdf>  Inspiration resource  <http://www.inspiration.com/community/Inspiration-Graphic-Organizer-Five-Systems-of-the-Human-Body>  Human body system diagrams  <http://www.curriki.org/xwiki/bin/view/Coll_bigleyj/SystemsoftheHumanBody>  Qwiki graphic organizers:  Cell <http://www.qwiki.com/q/#!/Cell_(biology)>  Human Body <http://www.qwiki.com/q/#!/Human_body> |
| **Science For All Americans** *(minimum ADULT content knowledge)* CELLS All self-replicating life forms are composed of cells—from single-celled bacteria to elephants, with their trillions of cells. Although a few giant cells, such as hens' eggs, can be seen with the naked eye, most cells are microscopic. It is at the cell level that many of the basic functions of organisms are carried out: protein synthesis, extraction of energy from nutrients, replication, and so forth.  All living cells have similar types of complex molecules that are involved in these basic activities of life. These molecules interact in a soup, about 2/3 water, surrounded by a membrane that controls what can enter and leave. In more complex cells, some of the common types of molecules are organized into structures that perform the same basic functions more efficiently. In particular, a nucleus encloses the DNA and a protein skeleton helps to organize operations. In addition to the basic cellular functions common to all cells, most cells in multicelled organisms perform some special functions that others do not. For example, gland cells secrete hormones, muscle cells contract, and nerve cells conduct electrical signals. BASIC FUNCTIONS in Humans The human body is a complex system of cells, most of which are grouped into organ systems that have specialized functions. These systems can best be understood in terms of the essential functions they serve: deriving energy from food, protection against injury, internal coordination, and reproduction.  The continual need for energy engages the senses and skeletal muscles in obtaining food, the digestive system in breaking food down into usable compounds and in disposing of undigested food materials, the lungs in providing oxygen for combustion of food and discharging the carbon dioxide produced, the urinary system for disposing of other dissolved waste products of cell activity, the skin and lungs for getting rid of excess heat (into which most of the energy in food eventually degrades), and the circulatory system for moving all these substances to or from cells where they are needed or produced.  Like all organisms, humans have the means of protecting themselves. Self-protection involves using the senses in detecting danger, the hormone system in stimulating the heart and gaining access to emergency energy supplies, and the muscles in escape or defense. The skin provides a shield against harmful substances and organisms, such as bacteria and parasites. The immune system provides protection against the substances that do gain entrance into the body and against cancerous cells that develop spontaneously in the body. The nervous system plays an especially important role in survival; it makes possible the kind of learning humans need to cope with changes in their environment.  The internal control required for managing and coordinating these complex systems is carried out by the brain and nervous system in conjunction with the hormone-excreting glands. The electrical and chemical signals carried by nerves and hormones integrate the body as a whole. The many cross-influences between the hormones and nerves give rise to a system of coordinated cycles in almost all body functions. Nerves can excite some glands to excrete hormones, some hormones affect brain cells, the brain itself releases hormones that affect human behavior, and hormones are involved in transmitting signals between nerve cells. Certain drugs—legal and illegal—can affect the human body and brain by mimicking or blocking the hormones and neurotransmitters produced by the hormonal and nervous systems.  PHYSICAL HEALTH in Humans  To stay in good operating condition, the human body requires a variety of foods and experiences. The amount of food energy (calories) a person requires varies with body size, age, sex, activity level, and metabolic rate. Beyond just energy, normal body operation requires substances to add to or replace the materials of which it is made: unsaturated fats, trace amounts of a dozen elements whose atoms play key roles, and some traces of substances that human cells cannot synthesize—including some amino acids and vitamins. The normal condition of most body systems requires that they perform their adaptive function: For example, muscles must effect movement, bones must bear loads, and the heart must pump blood efficiently. Regular exercise, therefore, is important for maintaining a healthy heart/ lung system, for maintaining muscle tone, and for keeping bones from becoming brittle.  Good health also depends on the avoidance of excessive exposure to substances that interfere with the body's operation. Chief among those that each individual can control are tobacco (implicated in lung cancer, emphysema, and heart disease), addictive drugs (implicated in psychic disorientation and nervous-system disorders), and excessive amounts of alcohol (which has negative effects on the liver, brain, and heart). In addition, the environment may contain dangerous levels of substances (such as lead, some pesticides, and radioactive isotopes) that can be harmful to humans. Therefore, the good health of individuals also depends on people's collective effort to monitor the air, soil, and water and to take steps to keep them safe.  Other organisms also can interfere with the human body's normal operation. Some kinds of bacteria or fungi may infect the body to form colonies in preferred organs or tissues. Viruses invade healthy cells and cause them to synthesize more viruses, usually killing those cells in the process. Infectious disease also may be caused by animal parasites, which may take up residence in the intestines, bloodstream, or tissues.  The body's own first line of defense against infectious agents is to keep them from entering or settling in the body. Protective mechanisms include skin to block them, tears and saliva to carry them out, and varied secretions to kill them. Related means of protecting against invasive organisms include keeping the skin clean, eating properly, avoiding contaminated foods and liquids, and generally avoiding needless exposure to disease.  The body's next line of defense is the immune system. White blood cells act both to surround invaders and to produce specific antibodies that will attack them (or facilitate attack by other white cells). If the individual survives the invasion, some of these antibodies remain—along with the capability of quickly producing many more. For years afterward, or even a lifetime, the immune system will be ready for that type of organism and be able to limit or prevent the disease. A person can "catch a cold" many times because there are many varieties of germs that cause similar symptoms. Allergic reactions are caused by unusually strong immune responses to some environmental substances, such as those found in pollen, on animal hair, or in certain foods. Sometimes the human immune system can malfunction and attack even healthy cells. Some viral diseases, such as AIDS, destroy critical cells of the immune system, leaving the body helpless in dealing with multiple infectious agents and cancerous cells.  Infectious diseases are not the only threat to human health, however. Body parts or systems may develop impaired function for entirely internal reasons. Some faulty operations of body processes are known to be caused by deviant genes. They may have a direct, obvious effect, such as causing easy bleeding, or they may only increase the body's susceptibility to developing particular diseases, such as clogged arteries or mental depression. Such genes may be inherited, or they may result from mutation in one cell or a few cells during an individual's own development. Because one properly functioning gene of a pair may be sufficient to perform the gene's function, many genetic diseases do not appear unless a faulty form of the gene is inherited from both parents (who, for the same reason, may have had no symptoms of the disease themselves).  The fact that most people now live in physical and social settings that are very different from those to which human physiology was adapted long ago is a factor in determining the health of the population in general. One modern "abnormality" in industrialized countries is diet, which once included chiefly raw plant and animal materials but now includes excess amounts of refined sugar, saturated fat, and salt, as well as caffeine, alcohol, nicotine, and other drugs. Lack of exercise is another change from the much more active life-style of prehistory. There are also environmental pollutants and the psychological stress of living in a crowded, hectic, and rapidly changing social environment. On the other hand, new medical techniques, efficient health care delivery systems, improved sanitation, and a fuller public understanding of the nature of disease give today's humans a better chance of staying healthy than their forebears had. |
| **NGSS Framework** *(draft - student knowledge)*  **LS1.A: Structure and Function** *(draft - K-12 overview)*  *How do the structures of organisms enable life’s functions?*  A central feature of life is that organisms grow, reproduce, and die. They have characteristic structures (anatomy and morphology), functions (molecular-scale processes to organism-level physiology), and behaviors (neurobiology and, for some animal species, psychology). Organisms and their parts are made of cells, which are the structural units of life and which themselves have molecular substructures that support their functioning. Organisms range in composition from a single cell (unicellular microorganisms) to multicellular organisms, in which different groups of large numbers of cells work together to form systems of tissues and organs (e.g., circulatory, respiratory, nervous, musculoskeletal), that are specialized for particular functions.  Special structures *within* cells are also responsible for specific cellular functions. The essential functions of a cell involve chemical reactions between many types of molecules, including water, carbohydrates, lipids, and nucleic acids. All cells contain genetic information, in the form of DNA, which is where genes are located. Genes contain the instructions that code for the configuration of molecules called proteins, which carry out the work of cells to perform the essential functions of life. That is, proteins provide structural components, serve as signaling devices, regulate cell activities, and determine the performance of cells through their enzymatic actions.  **Grade Band Endpoints for LS1.A**  ***By the end of grade 2*.** All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants.  ***By the end of grade 5*.** Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (Boundary: Stress at this grade level is on understanding the macro scale systems and their function, not microscopic processes.)  **LS1.D: Information Processing** *(draft - K-12 overview)*  *How do organisms detect, process, and use information about the environment?*  An organism’s ability to sense and respond to its environment enhances its chance of surviving and reproducing. Animals have external and internal sensory receptors that detect different kinds of information, and they use internal mechanisms for processing and storing it. Each receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as impulses that travel along nerve cells. In complex organisms, most such inputs travel to the brain, which is divided into several distinct regions and circuits that serve primary roles, in particular functions such as visual perception, auditory perception, interpretation of perceptual information, guidance of motor movement, and decision making. In addition, some of the brain’s circuits give rise to emotions and store memories. Brain function also involves multiple interactions between the various regions to form an integrated sense of self and the world around.  **Grade Band Endpoints for LS1.D**  ***By the end of grade 2.*** Animals have body parts that capture and convey different kinds of information needed for growth and survival—for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun).  ***By the end of grade 5*.** Different sense receptors are specialized for particular kinds of information, which may then be processed and integrated by an animal’s brain, with some information stored as memories. Animals are able to use their perceptions and memories to guide their actions. Some responses to information are instinctive—that is, animals’ brains are organized so that they do not have to think about how to respond to certain stimuli. |
| **Unpacked Content** *(for students)*  5.L.1.1  Students know that unicellular organisms consist of a single cell and perform all life processes within a single cell. Students know that multicellular organisms are organisms that consist of more than one cell and have differentiated cells that perform specialized functions in the organism. Students know that many organisms –including humans – are multicellular. Students know that in complex multicellular organisms, only the surface cells that are in contact with the external environment are able to exchange substances with it. Cells within the organism are too far away from the environment for direct exchange. This is the reason multicellular organisms have developed transport systems.  5.L.1.2  Students know that there are many systems in the human body. Some of these systems are:  • Circulatory System (heart, blood, vessels)  • Respiratory System (nose, trachea, lungs)  • Skeletal System (bones)  • Muscular System (muscles)  • Digestive System (mouth, esophagus, stomach, intestines)  • Nervous System (brain, spinal cord, nerves)  Students know that each system performs a special life process function and that the systems work together to maintain health and fitness. |
| **Identify Student Misconceptions**  \*Construct formative assessment probes – see ‘how to’ on pages 85, 102, and 183 in Science Formative Assessment by Page Keeley.  Use formative probes: Uncovering Student ideas in Science, Volumes 1-4, by Page Keeley  (I) Volume 1 Is it Made of Cells? P. 131 (II) Volume 1 Human Body Basics p. 139 (III) Volume 1 Functions of Living Things p.147 (IV) Volume 2 Whale and Shrew p. 137 (V) Volume 3 Cells and Size p. 117 (VI) Volume 3 Sam’s Puppy p. 125 (VII) Volume 3 Respiration p. 131 (VIII) Volume 4 Digestive System p. 131  Formative Assessment Probes (articles, how-to, free-online) by Page Keeley, et al <http://pal.lternet.edu/docs/outreach/educators/education_pedagogy_research/assessment_probes_uncovering_student_ideas.pdf>  <http://www.ode.state.or.us/teachlearn/subjects/science/resources/msef2010-formative_assessment_probes.pdf> |
| **North Carolina Connections:** (local and state resources)  [Catawba Science Center](http://www.catawbascience.org/) CSC also provides a variety of educational and fun programming for school groups, children, families, adults, and other community groups. 243 3rd Avenue NE (street address), P.O. Box 2431, Hickory, NC 28603, (828) 322-8169  [Imagination Station Science Museum](http://www.imaginescience.org/) Interactive programs are designed to promote student investigation into various science concepts. 224 East Nash Street,Wilson, NC 27894 Phone (252) 291-5113.  [North Carolina Museum of Life and Science](http://www.ncmls.org/) Experience how inquiry-based teaching energizes your students and encourages science discovery. 433 West Murray Avenue (street address), P.O. Box 15190, Durham, NC 27704, (919) 220-5429  [SciWorks, the Science Center and Environmental Park of Forsyth County](http://www.sciworks.org/) Enjoy interactive, hands-on special exhibits and programs in spacious exhibit halls. 400 West Hanes Mill Rd., Winston-Salem, (336) 767-6730  **North Carolina NASA Educator Resource Center** J. Murrey Atkins Library UNC Charlotte 9201 University City Blvd., Charlotte, NC 28223 704-687-2559 |
| **Annotated TEACHER Resources**  [**Systems of the Human Body**](http://www.sciencenetlinks.org/lessons.cfm?BenchmarkID=11&DocID=385)  oai:nsdl.org:crs:65231  <http://www.sciencenetlinks.org/lessons.cfm?BenchmarkID=11&DocID=385>  In this Science NetLinks lesson, students use an online interactive activity to learn about the concept of separate components working together to build a body system. In addition, this lesson focuses on activities to help students learn that body systems work together to build the functioning human body.  [**Inside the Human Body: The Respiratory System**](http://www.lung.ca/children/index_kids.html)  oai:nsdl.org:crs:1007936|oai:nsdl.org:crs:4721  <http://www.lung.ca/children/index_kids.html>  This Web site from the Canadian Lung Association contains an excellent collection of learning resources about the respiratory system for grades 1-12.  [**Circulatory System Skit**](http://www.smm.org/heart/lessons/lesson10.htm)  oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-112-013  <http://www.smm.org/heart/lessons/lesson10.htm>  In this activity, learners act out the flow of blood in the human body! A great way to get learners up and moving while learning about the circulatory system.  **Digestion animation**  <http://health.howstuffworks.com/human-body/systems/digestive/adam-200086.htm>  This animation traces the path of food along the digestive system and explains how each major organ contributes to the absorption of nutrients and the removal of waste.  **Digestion at Enchanted learning**  <http://www.enchantedlearning.com/subjects/anatomy/digestive/>  Information and printouts.  [**Digestive System, a Kinesthetic Lesson**](http://www.accessexcellence.org/AE/AEC/AEF/1995/cave_digest.php)  oai:nsdl.org:crs:65231|oai:nsdl.org:crs:439881  <http://www.accessexcellence.org/AE/AEC/AEF/1995/cave_digest.php>  Students act out each digestive function of the organs, tissues, and cells in the tract as the food particle comes to them.  **Nature’s Best the Human Body**  <http://library.thinkquest.org/2935/>  A multi media thinkquest site where students can learn all about the human body.  **The Virtual Body**  <http://www.medtropolis.com/VBody.asp>  a multi media introduction to the Human brain, skeleton, heart and digestive tract.  **Human Skeleton at Enchanted learning**  <http://www.enchantedlearning.com/subjects/anatomy/skeleton/index.shtml>  Information and printouts.  **How the Body responds to Exercise**  <http://www.teachersdomain.org/resource/oer08.sci.life.reg.exercise/>  This video segment adapted from *NOVA* describes the effect of exercise on the body. It discusses how muscles use oxygen as well as the body’s response to the demands of physical activity.  **From the Heart**  <http://www.teachersdomain.org/resource/tdc02.sci.life.stru.circulator/> (video)  <http://www.teachersdomain.org/resource/tdc02.sci.life.stru.lp_circula/> (lesson plan)  This video segment describes how the chambers of the heart contract and relax in synchrony to push blood through the pulmonary and systemic loops of the circulatory system. You'll see how the heart pumps oxygen-depleted blood to the lungs, where red blood cells acquire oxygen before travelling back to the heart and then on to the rest of the body.  **All Systems are Go**  <http://www.teachersdomain.org/resource/lsps07.sci.life.stru.bodysystems/>  In this interactive activity from Kinetic City, Arnold is missing all of his organ systems. Help Arnold identify these important organ systems and put them back into his body where they belong.  **Digestion Simulation**  <http://teachengineering.org/view_lesson.php?url=http://www.teachengineering.org/collection/cub_/lessons/cub_biomed/cub_biomed_lesson05.xml>  To reinforce students' understanding of the human digestion process, the functions of several stomach and small intestine fluids are analyzed, and the concept of simulation is introduced through a short, introductory demonstration of how these fluids work.  **\*NSBRI – National Space Biomedical Research Institute**  **Muscles and Bones**  <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Elementary/Muscles-and-Bones/>  10 activities that help students understand how the body's muscles and bones work.  **Heart and Circulation**  <http://www.nsbri.org/EDUCATION-and-TRAINING/Teaching-Resources/Elementary/Heart-and-Circulation/>  This guide offers nine activities that help students understand the heart and circulatory system. Using examples from current research on human space travel, this guide engages students in authentic questions and investigations.  **\*NASA Resources\***  **Exploration: Then and Now -- NASA and Jamestown Education Module**  <http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Jamestown_Exploration_Cover.html>  A unit of lessons with 5 E stages that examine human survival needs by comparing the age of exploration to space exploration. Nice integration of Science and Social studies components. For best results with upper elementary students, use *Survival* and *Human Needs* lessons.  **Living and Working in Space: Habitat**  <http://www.nasa.gov/audience/foreducators/son/habitat/index.html>  This problem based learning unit requires students to propose and defend a design for a research habitat on the moon or Mars. *Healthy Choices* and *Air and Water* focus more distinctly on needs of the human body.  **Water Filtration Design Challenge**  <http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Water_Filtration_Challenge.html>  Students design and build a water filtration device.  **How would Your Body Change in Space?**  <http://education.jsc.nasa.gov/explorers/p3.html>  Students complete an activity that demonstrates one type of effect that a reduced gravity environment produces.  **Smart Exchange**  <http://exchange.smarttech.com/search.html>  A directory of Smart Board lessons that teachers can download and use. Search by grade band (3-5) and human body system for a collection of Smartboard lessons on Human Body System topics.  **Teachers Domain**  <http://www.teachersdomain.org/>  Free digital media for educational use.  **The Brain**  [**http://www.teachersdomain.org/resource/idptv11.sci.life.stru.d4kbrn/**](http://www.teachersdomain.org/resource/idptv11.sci.life.stru.d4kbrn/)  This video segment from IdahoPTV's *D4K* examines the anatomy and function of the different parts of the brain: the cerebrum, cerebellum, hemispheres, limbic system, neurons, spinal cord, brain stem and cortex. It emphasizes that the 3 pound brain grows into adulthood so it is important to protect it.  **A Matter of Size**  [**http://www.teachersdomain.org/resource/hs11.sci.life.reg.mattsize/**](http://www.teachersdomain.org/resource/hs11.sci.life.reg.mattsize/)  This video adapted from *The Human Spark* compares the size of a human brain with the brains of a chimp, a monkey and a rat.  **Cellular Service**  [**http://www.teachersdomain.org/resource/tdc02.sci.life.stru.bloodtrekweb/**](http://www.teachersdomain.org/resource/tdc02.sci.life.stru.bloodtrekweb/)  In order to survive, every living cell in the body needs a constant supply of oxygen and nutrients and needs to have wastes removed. In this interactive game, you'll follow a small sample of blood as it travels throughout the body  **All Systems are Go**  [**http://www.teachersdomain.org/resource/lsps07.sci.life.stru.bodysystems/**](http://www.teachersdomain.org/resource/lsps07.sci.life.stru.bodysystems/)  In this interactive activity from Kinetic City, Arnold is missing all of his organ systems. The organs of the human body are critical for maintaining conditions that are necessary for life, and must operate in concert with each other to do their jobs. Help Arnold identify these important organ systems and put them back into his body where they belong.  **The Human Body at ppst**  <http://science.pppst.com/humanbody/index.html>  Powerpoint presentations, games, activities and more about the various body systems from the powerpoint station.  **Digestive System Song**  [**http://www.teachertube.com/music.php?music\_id=7364&title=I\_can\_t\_believe\_it\_Remix\_Digestive\_System\_Song**](http://www.teachertube.com/music.php?music_id=7364&title=I_can_t_believe_it_Remix_Digestive_System_Song)  **Muscles Rap**  [**http://www.youtube.com/watch?v=4NcGcSRggSk&feature=related**](http://www.youtube.com/watch?v=4NcGcSRggSk&feature=related)  **Nervous System Song**  [**http://www.youtube.com/watch?v=40EBLb1avhM**](http://www.youtube.com/watch?v=40EBLb1avhM)  **Circulatory System song**  <http://www.youtube.com/watch?v=LqhvmUEdOYY>  **Bill Nye Human Body videos**  <http://www.gamequarium.org/dir/SqoolTube_Videos/Science/Bill_Nye_Videos/Human_Body/> |
| **WRITING PROMPTS**   1. If you were to become a doctor, which body system would you most want to be your area of focus? Explain your choice and tell what your job would be like. 2. Some people think humans could survive by eating the same three meal menu daily. Others think there must be more variability in our diet in order for us to be truly healthy. What do you believe is the case? Explain your position. 3. Write a story about a character who eats nothing but chocolate all day, every day. Describe this character in detail and make sure to explain how chocolate came to be the only food he/she consumes. 4. Describe what your favorite foods were when you were very young. 5. Pretend you are a human body part, organ, or system. Nominate yourself for BOS (body part, organ, or system) of the year. Explain in your nomination essay the many things that you do to help humans survive, and why you are the most important body part, organ, or system. |